



Wulfsberg Electronics

COBHAM
Avionics & Surveillance

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Radio Interference Troubleshooting Reference

Introduction

The following procedures are intended for use as a reference, taking into account that the installer has used the appropriate product Installation Manual and followed the guidelines within.

A well designed installation is sometimes subject to RF interference due to the amount of airframe space needed for the number of antennas required in a particular installation.

When experiencing RF interference, the problems often fall into one or more of the following categories:

1. Improper or inadequate installation
2. Defective or inadequate avionics
3. System Interaction

Outlined below are some relatively simple tests that can be performed to isolate the most common causes of interference.

Installation Troubleshooting

Antenna Installations

RF antennas should be mounted on a **flat, unpainted, metal surface** and have good electrical conductance with the metallic airframe.

Proper grounding should yield a reading of less than 0.1Ω from airframe to antenna base. A sufficient ground plane will need to be manufactured if the installation is on a composite airframe or panel.

The antenna should preferably be mounted to the bottom of the aircraft and **away from other antennas** and other protruding airframe structures in order to avoid antenna or airframe interaction and re-radiation, and allow for the best line-of-sight communications.

Interference can result when an antenna is mounted among other aircraft antennas and should be mounted **as far as possible** from other aircraft antennas. Avionics technicians often underestimate the problems that result from antennas being too close and the results are not always obvious. After all, the Flexcomm II™ Wulfsberg RT-5000 is capable of over 600,000 different tuned frequencies.

After you've gone through the pain staking process of performing a good antenna installation, don't forget to apply a **waterproof sealant** to protect the antenna bonding to the airframe to keep water and foreign matter from degrading the connection over time.



RF Cables and Connectors

In-line RF connectors should be used only when absolutely necessary, because each additional connection will contribute to **insertion loss**.

Coaxial cables should be inspected for proper assembly, tested for shorts between the center conductor and the shielding, and tested for low resistance continuity from end to end. Antenna coax cables should always be **as short as possible** while avoiding areas of interference.

Signal lines such as RS-422, ARINC 429, etc should also be installed with shielded, twisted pairs to avoid **digital noise** affecting the received audio.

All **ground strapping** should be 2" or less. Longer runs can assume the characteristics of an antenna, which can also introduce noise into the audio.

Multiple RF Antenna Connections

Some units such as the RT-5000 have multiple RF antenna cables and connectors. Verify that there are no reversed antenna connections at any point between the radio and the antenna. **Reversed connections** can cause spurious output, antenna damage or failure, and radio power amplifier failure.

The RT-5000 high frequency RF antenna connector (TNC) at the radio should be coupled to the high frequency antenna connector at the antenna and the low frequency radio connector (N type) should be coupled to the low frequency antenna connector.

Cable Shielding and Routing

To provide the best protection from interference and insertion loss, the antenna coax cables should be a type providing low loss and **double shielding** such as RG-142, RG-393, etc. Route each cable as far as practical from any other source of RF interference including: other cables and wiring (especially those transferring RF energy), wiring, and other avionics and aircraft systems.

Test for Voltage Standing-Wave Ratio (VSWR)

This test should be done prior to transmitting on all new installations and is a standard for troubleshooting antenna system problems.

Install an inline wattmeter at the connector of the transmitting radio to measure VSWR. Excessive VSWR is indicative of reflected power and insertion loss.

Results

If excessive VSWR is measured at the radio RF port, perform the same test at the antenna to determine whether or not the antenna, cable, and/or antenna bonding are relative to the problem.

Solution

Repair or replace the antenna cable or antenna as necessary.



Test for Radiated Interference – Simulated Test Load ‘dummy load’

Install a 50Ω dummy load in place of the RF antenna to determine whether or not the problem is being caused by radiated energy.

The dummy load can also be used to replace the antenna on the receiving radio as an indicator.

Results

If the problem exists with the dummy load in place, the problem is most likely being caused by something other than radiation, such as excessive VSWR or spurious emissions due to poor bonding, shielding, wiring, cable routing, defective avionics, etc.

Solution

Troubleshoot using the guidelines mentioned previously.

Results

If the problem does not exist with the dummy load in place, there is most likely a radiation problem that can be attributed to proximity of the system components or harnessing, poor bonding or shielding, etc.

Solution

Troubleshoot using the guidelines mentioned previously.

Test for Radiated Interference – Handheld Radio

Tune a compatible handheld radio or portable communications analyzer to the same Rx frequency as the effected aircraft radio and monitor while transmitting on the opposite aircraft radio.

Results

If the interference is observed at a moderate distance from the aircraft, there is most likely a radiation problem that can be attributed to proximity of the system components or harnessing, poor bonding or shielding, etc.

Solution

Troubleshoot using the guidelines mentioned previously.

Results

If the interference is not observed at a moderate distance from the aircraft, it is being caused by something other than radiation, such as excessive VSWR or spurious emissions due to poor bonding, shielding, wiring, cable routing, defective avionics, etc

Solution

Troubleshoot using the guidelines mentioned previously.



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Avionics LRU Troubleshooting

Defective Avionics

Damage to the individual avionics Line Replaceable Units (LRU) can result from installation problems, therefore, it is recommended that the installation be tested prior to exchanging the LRUs, so that subsequent units are not damaged.

Some antennas require the use of an **antenna tuner** (or logic converter). Excessive VSWR may result if the tuner does not change with the selected frequency of the radio.

A defective radio can produce spurious emissions or be susceptible to EMI. Removal and replacement of the radio is the easiest way to troubleshoot such problems.

Inadequate Avionics

Receiver overload may occur when a transmitter signal bleeds into another receiver antenna on the aircraft.

Excessive **receiver sensitivity** can cause the squelch to open due to the high signal strength of co-located avionics resulting in RF interference.

The best solution for either of the above problems is to distance the antenna systems as far as possible from each other. Receiver sensitivity can sometimes be aligned in the field depending on the unit.

AM Notch Filter

There is a hardware modification available for the RT-5000 designed for aircraft that have a high volume of nav/com avionics and limited amount of airframe space available for antenna mounting.

Contact Wulfsberg Product Support for details regarding your specific radio/s to verify if you already have this upgrade installed or not.

Tx Interlock

Some radios have the option to install connection(s) that desensitize the receiver of a radio while a co-located radio is in a state of transmit. This prevents the receiver squelch from reacting to the output of the transmitting radio.

The RT-5000 has a built in receive attenuator to desensitize the receiver.

The RT-5000 and Flexcomm I™ series radios also have receive attenuation options that can be installed to reduce sensitivity upon customer request. This may be useful in high RF areas such as major metropolitan areas.



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